

Demonstration of a Thermally-Controlled Shipping Container for NanoRack and CubeSat Payloads, Phase I

Completed Technology Project (2012 - 2012)



Project Introduction

A significant challenge faced by space-bound experiment packages is the requirement for a minimally controlled environment while a small payload is awaiting launch or is in transit to the International Space Station (ISS). NASA is seeking thermal solutions for the transportation of NanoRack and CubeSats experimental payloads. This proposal discusses a unique thermally-controlled storage/shipping container that can provide active cooling to maintain a pre-determined set-point temperature during the storage and transport of small payloads prior to being loaded aboard the Soyuz launch vehicle for transport to the ISS. For example, as discussed further in this proposal, this lightweight, compact, reusable, shipping container can provide 60±aF thermal environment inside the container, when exposed to 130±aF ambient temperature for at least 12 hours while only being powered by two commercial AA NiMH rechargeable batteries (and unlimited duration thermal control when connected to external power). The Thermally Controlled Shipping Container for small satellite payloads will also have data recording and wireless monitoring capability. Phase I will demonstrate the system with a NanoRack or CubeSat payload, thereby reducing the risk during a follow-on Phase II effort. This proposal contains technical details and photographs of critical components of the system, which have already been demonstrated on Internal R&D (to clearly demonstrate the potential of the proposed approach). A detailed commercialization study which shows a significant markets for this technology in the microclimate cooling, electronic cooling and thermally-controlled shipping container markets is also included. Mainstream is well versed in this technology, has critical patents pending on the technology, and this work dovetails well with our existing and developing product lines. Mainstream has sufficient financial resources and experience to commercialize this technology.



Demonstration of a Thermally-Controlled Shipping Container for NanoRack and CubeSat Payloads, Phase I

Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	2
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destinations	3

Demonstration of a Thermally-Controlled Shipping Container for NanoRack and CubeSat Payloads, Phase I

Completed Technology Project (2012 - 2012)



Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Mainstream Engineering Corporation	Lead Organization	Industry	Rockledge, Florida
● Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations	
California	Florida

Project Transitions

▶ **February 2012:** Project Start

✓ **August 2012:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/138076>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Mainstream Engineering Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

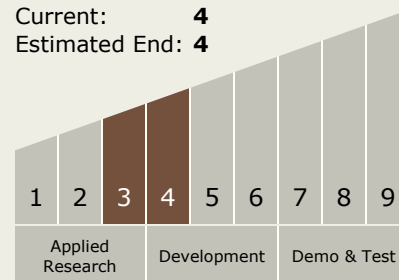
Carlos Torrez

Principal Investigator:

Robert Scaringe

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Demonstration of a Thermally-Controlled Shipping Container for NanoRack and CubeSat Payloads, Phase I

Completed Technology Project (2012 - 2012)



Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.1 Cryogenic Systems
 - └ TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System